

# **Safe Management of Mineral Acids in MSD**

**Mandatory Safety Stand Down  
Division Safety Committee Meeting  
June 4, 2009**

# Paul Alivisatos Mandates Safety Stand Down for Use of Strong Acids

- ◆ All use of strong acids (mineral acids >1%) suspended pending completion of review
- ◆ Review must be complete by 6/12/09
- ◆ Triggered by acid waste explosions in 66 and 6



# Requirements of Stand Down



Materials Sciences Division

- ◆ **1) Incompatible waste materials are kept separate**
- ◆ **2) Procedures and practices are in place to prevent the mixing of such materials, and**
- ◆ **3) Personnel performing these operations are aware of and familiar with the approved procedures and practices.**

# B 66 Explosion in March



Materials Sciences Division



- Alcohol inappropriately added to nitric/hydrochloric waste mixture
- Glass container overpressurized and exploded
- Shattered the hood sash
- Nobody hurt because nobody was in the room
- Acid waste co-stored with flammable waste

# Preliminary Factors in Explosion

---



- **Methods used for waste accumulation at LBNL are not the safest**
- **Division did not manage the “span of control” issue with the PI, work authorization not executed effectively**
- **The JHA process was not properly implemented and guest did not complete required training**
- **Required assistance to new guest was not provided**
  - Direct oversight**
  - Assumptions about training and qualifications**
  - Cultural issues**

# ALS Acid Waste Explosion Last Weekend

---



- **HF/Nitric/Acetic acid mixture used to etch silicon**
- **Wafer rinsed with water and alcohol**
- **Rinsate waste placed in a sealed plastic bottle that exploded**
  - User splashed with liquid waste, used shower, called 911, transported to Alta Bates**
  - No injury, just precautionary**
- **Cause of explosion not yet known**



# Not the first waste explosion in MSD

- Basic piranha etch: 2007
- Acid piranha etch: 2008
- Nitric acid + alcohol: 2006

**Luckily nobody has  
been hurt!**



5/10/06

# Safe Storage, Use and Waste Handling for Acids



# Acid Reagent Storage

---



- Segregated from flammables, bases, other reactive materials
- Store only in rooms with eyewash and emergency shower
- Provide secondary containment tray
- Stored in dedicated space with tightly closed caps



# Acid Reagent Storage

---



- Do not store piranha etch or aqua regia
- Do not store with organic acids
- Store nitric and hydrochloric in separate secondary containments
- Have a spill kit available (may require a special kit for HF)
- Perchloric: Do not store in wooden cabinet
- HF: Must have calcium gluconate spill kit

# Handling of Mineral Acids

---



- Always use personal protective equipment:
  - Low risk of splash*— Goggles, resistant gloves, lab coat
  - Higher risk of splash* – Goggles, faceshield, resistant gloves, lab coat, rubber/vinyl apron



# Handling of Mineral Acids



- Work in a fume hood or glove box
- Make sure an eyewash and shower are available
- Work with secondary containment trays when possible



# Handling of Mineral Acids

---



- **Require prior review by Rick**
  - Use of hot perchloric acid
  - Use of pressurized HF requires prior review
  - Use of >90% nitric acid
- **Completely segregate acid use from cyanide use**
- **Follow additional procedures specified in the LBNL Chemical Hygiene and Safety Plan available at:**  
***[http://www.lbl.gov/ehs/chsp/html/acids\\_bases.shtml](http://www.lbl.gov/ehs/chsp/html/acids_bases.shtml)***

# Handling of Mineral Acids

---



- Abide by your groups written policy on “working alone” with materials that could impair your ability to self rescue
- Operations involving strong acids where there is a possibility of getting a substantial splash should never be conducted when alone after-hours or on weekends



# Handling of Acid Waste

---



- Store in SAA, fully segregated from other wastes
- Best storage container—Probably plastic coated glass bottles
- Best storage location: Dedicated cabinet with doors (e.g. under fume hood)
- Use pressure relieved lids
- Properly label containers
- If mixed acids, use waste accumulation log to record all additions





# Handling of Acid Waste

---



- **Never add fuels to strong acids waste, particularly strong oxidizing acids (nitric, sulfuric, perchloric, phosphoric)**
- **Do not store piranha etch or aqua regia waste—these must be treated when generated to neutralize them**
  - All known users of these have been contacted individually with instructions**
- **Where available (Foundry clean room, some rooms in B2 only) pour these wastes down the drain to the neutralization system**

# Plastic Coated Bottles



## Safebreak - The Right Bottle



The computer-designed exclusive Merck Safebreak bottle combines all the advantages in one:

- It meets all safety requirements
- It guarantees that the customer receives exactly the same quality of content as that dispatched from Merck
- It can be incorporated in all logistic systems
- It can be easily and ecologically disposed of and re-used

### The conventional glass bottle

- Risk of cracks or breakage
- Risk of injury to the user
- Risk of contamination of the environment
- Can be recycled as glass

### The PE-oated safety bottle

- Withstands considerable impact force
- User cannot be injured by escaping acid
- Is protected from leakage/contamination of the environment
- Can be recycled as glass

The Merck Safebreak bottle provides more safety for the following acids:

Product	Pack Size	Cat. No.
Acetic Acid (glacial) 100% GR ACS, ISO	1 x 2.5 litres	1.00063.2510
Perchloric Acid 60% GR, ACS, ISO	1 x 1 litre 1 x 2.5 litres	1.00518.1001 1.00518.2501
Perchloric Acid 70-72% GR, ACS, ISO	1 x 1 litre 1 x 2.5 litres	1.00519.1001 1.00519.2501
Nitric Acid 65% GR, ISO	1 x 2.5 litres	1.00456.2510
Nitric Acid, fuming, 100% GR, ISO	1 x 1 litre	1.00455.1000
Hydrochloric Acid, fuming, 37% GR, ISO	1 x 2.5 litres	1.00317.2510
Sulfuric Acid 95-97% GR, ISO	1 x 2.5 litres	1.00731.2510
Sulfuric Acid, fuming, 30% SO <sub>3</sub> , GR	1 x 1 litre	1.00721.1000

# Response to Acid Exposure

---



- Immediately remove contaminated clothing and use emergency shower
- Have someone contact 7-911 for all but the smallest exposures
- Continue rinsing for 15 minutes or until paramedics arrive
- For HF—after 5 minutes, stop rinsing and apply calcium gluconate



***Note: ALL HF exposures should be treated as emergencies!***

# Follow Rules For Work Authorization

---



- To be authorized to work with acids (or anything else) you must:
  - Have an accurate, approved JHA
  - Discuss your JHA with your work lead
  - Complete specified LBNL EH&S training
  - Complete lab/operation specific on-the-job training (OJT training must be documented)
  - Have all the tools and knowledge to work safely with acids:
    - Proper PPE
    - Working alone policy
    - Spill kit
    - Fume hood or glove box
    - Emergency shower/eyewash

Training Exception:  
Working under constant,  
direct, line-of-sight  
supervision for up to 7 days

# Follow Rules For Work Authorization

---



- If you share your lab with others, make sure that these people are qualified to perform the work they intend to do  
—JHA, formal training, OJT
- If you receive training to perform an operation or use a piece of equipment, and are not told about the safety aspects, it is your responsibility to ask how to safely perform the work
- Everyone has the right *and* responsibility to stop work that may be hazardous

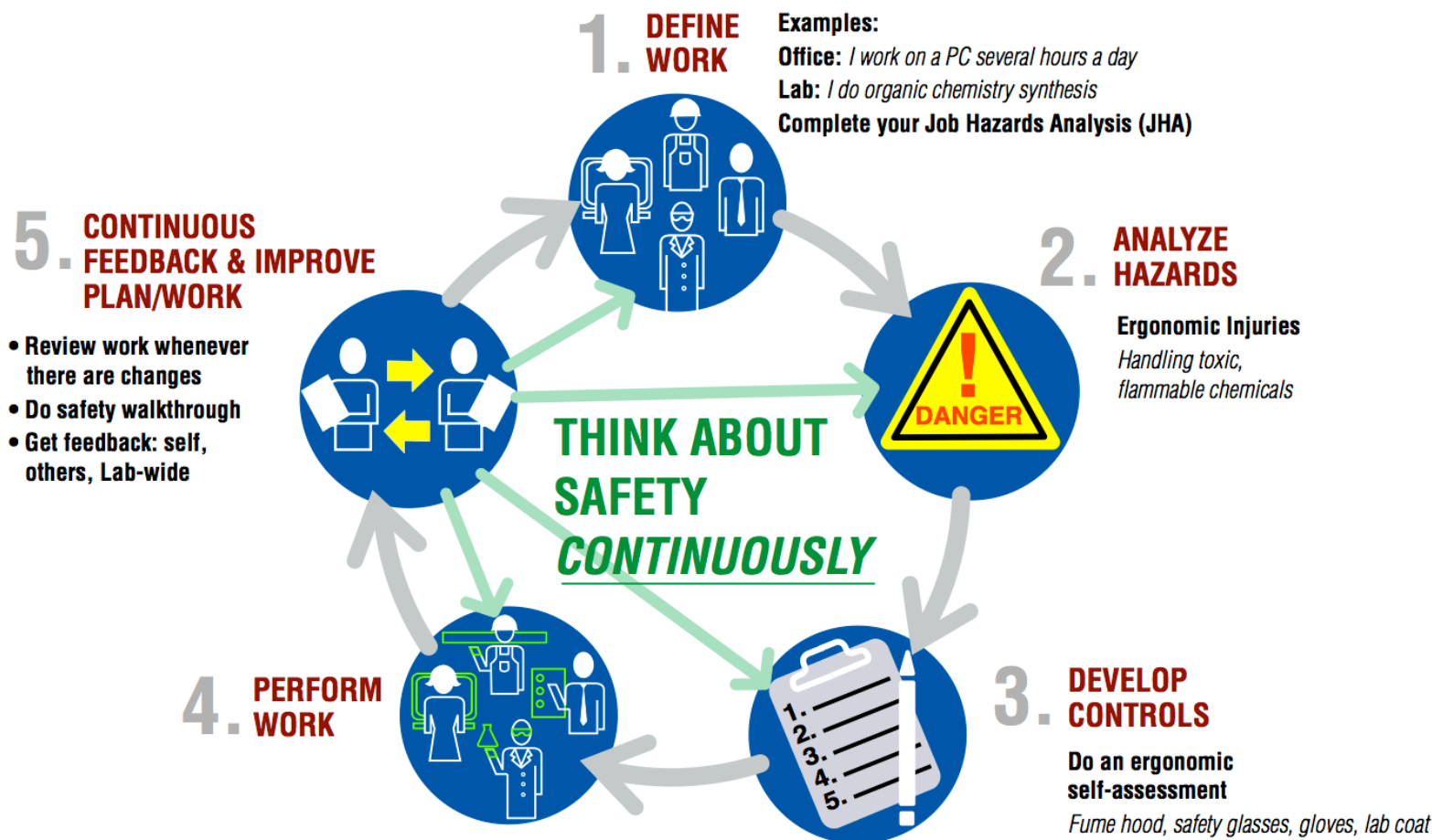
# Think About Safety Continuously!



## INTEGRATED SAFETY MANAGEMENT (ISM) & JOB HAZARDS ANALYSIS (JHA)



Environmental Energy  
Technologies Division



MSD Safety Stand Down

# Think About Safety Continuously!

---



- Always ask yourself:
  - What could go wrong
  - How probable is each failure
  - For failures that are possible
    - How can you reduce the *likelihood* of failure
    - How can you reduce the *consequences* of failure
  - Am I comfortable that I can do this work safely
  - Should I be doing this work alone after-hours?





---

# Stand Down Process

# Expectation



Materials Sciences Division

- ◆ You will return to your labs, meet with your supervisor and work lead and present this material to them
- ◆ All members of the group will be required to review these materials
- ◆ Inspect each acid storage, use and waste management area to make sure it is fully compliant
- ◆ Review training of everyone authorized to use acids
- ◆ Complete checklist and submit to Susan Waters
- ◆ Authorization to resume work with acids will follow if all items have been successfully addressed

# Questions?



Materials Sciences Division

---